Community Based Master's Project:
HPV Vaccine and sub-Saharan Africa: A Complementary Study of Senegal and Ghana, West Africa

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Background

HPV, Cervical Cancer, and sub-Saharan Africa

The *Human Papilloma Virus* (HPV) is a one of the most commonly sexually transmitted infections in the world (Awolude, Morhason-Bello, Denny, & Adewole, 2013; CDC, 2014). The virus is transmitted primarily through vaginal and anal intercourse and can also be transmitted via oral sex (CDC, n.d. a.). Not all infections however, cause disease; most people who are infected with the virus exhibit no symptoms (CDC, 2014). In fact, in many cases, HPV infection is self-resolving (Awolude et al., 2013). However, persistent infection with HPV is associated with a variety of diseases including genital warts and head and neck cancers (CDC, 2014; Cutts et al., 2007). Perhaps the most pressing disease contribution from HPV is its role in preventable cervical cancer incidence and mortality. HPV is responsible for almost all cases of cervical cancer in the world (WHO, n.d. a). Cervical cancer is the fourth most common cancer of women worldwide, affecting more than 500,000 women annually (Bruni et al., 2015).

Like so many other diseases, there exists a stark disparity in cervical cancer incidence and mortality. Cervical cancer mortality disproportionately impacts countries in sub-Saharan Africa (Awolude et al., 2013; El-Khatib, Tota, & Kaufmann, 2012). Over 270,000 women die from cervical cancer annually (LaMontagne et al., 2011) and well over 85% of the cervical cancer mortality burden lies in sub-Saharan Africa (WHO, n.d. a.). There are over 40 different strains of the virus (CDC, 2014) and while all of these strains can cause infection, there are high risk strains are more carcinogenic than others. These include strains 16 and 18, which cause nearly 70% of cervical cancers and exhibit high prevalence in Africa in particular (Awolude et al., 2013; Bruni et al., 2015; Cutts et al., 2007). HIV/AIDS also adds a significant layer of complexity to HPV infection. HIV and other immune-compromising diseases contribute to higher levels of HPV infection as those with immunosuppressant diseases are more susceptible to HPV infection (Awolude et al., 2013; Cutts et al., 2007; Sankaranarayanan et al., 2013).

The cervical cancer disparity is further exacerbated by the lack of proper screening and oncologic infrastructure in developing countries for early detection and treatment of the disease (Sankaranarayanan et al., 2013). Traditionally, pap smears are a widely useful secondary prevention method for the early detection of cellular changes in the cervix and possible cervical abnormalities ("Tests and Procedures: Pap smear," n.d.). However, this methodology of screening, requiring a laboratory, is often either unavailable or unfeasible in developing countries due to the lack of sustainable infrastructure for cytological screening (Sankaranarayanan et al., 2013). Methods for screening in resource-limited settings have been developed as an alternative to Pap Smear testing. Visual inspection of cervical cells using acetic acid have shown success in detecting cervical abnormalities in the absence of laboratory testing of cervical cells (Sankaranarayanan et al., 2013). However, both of these methods stop short of preventing cervical cancer infection outright.

The introduction the HPV vaccine presents the potential for significant global impact in the fight against cervical cancer and a necessary preventative strategy for women and girls around the world especially in light of limited screening and cancer treatment facilities.

Primary Prevention – The HPV Vaccine

There are three vaccinations against HPV currently on the market. Two have have subsequently received licensures for distribution in various countries around the world (Eisele & Munshi, 2013; Monie, Hung, Roden, & Wu, 2008). The *Gardasil* vaccine; which protects against

HPV types 6, 11, 16, 18; was created by Merck and received FDA approval in 2006; and *Cervarix,* which protects against HPV types 16 and 18, was created by GlaxoSmithKline and received FDA approval in 2009 (Cutts et al., 2007; FDA, 2006, 2009). The vaccines are both highly 95% efficacious in protecting against HPV infection (Cutts et al., 2007). The *Gardasil* vaccine is approved for use on both men and women ages 9-26, while *Cervarix* has been approved for use on women ages 9-25 (FDA, 2006, 2009). Although the vaccine recommendations extend until the mid-20s, the vaccine is not as effective for people who have not already had a prior HPV infection. For this reason, vaccination efforts are targeted to adolescents ages 9-13 to initiate and complete vaccination before sexual debut (CDC b., n.d.). In most developing countries, the focus is still on vaccinating girls (WHO b., n.d). This in part due to the high cost of the vaccine. An average dose of the *Gardasil* costs $100, meaning a full course of the vaccination, three injections, would cost $300 (Cutts et al., 2007). This represents a significant financial barrier for resource limited countries that wish to protect their women via vaccination.

Recent assistance from the Global Alliance for Vaccines and Immunizations (GAVI) has been instrumental in providing access to the HPV vaccine for sub-Saharan Africa countries (GAVI, 2013). Through the work of GAVI, countries are able to purchase the HPV vaccination from manufacturers for $4.50 a dose (GAVI, 2013). GAVI vaccine demonstrations focus their preventative efforts on girls aged 9-13. As per WHO recommendations, it is most cost effective to focus vaccination on this population of girls (A. Sidibe, personal communication, February 4, 2016). GAVI vaccine demonstrations have begun in several sub-Saharan Africa countries including Ghana and Senegal. Senegal and Ghana both have high rates of cervical cancer incidence and mortality, Senegal having the second highest age standardized incidence rates, followed by Ghana with the 4th highest (Bruni et al., 2015) making the need for cervical cancer interventions and prevention strategies urgent in these two settings. As the vaccine delivery strategies proceed with the assistance of GAVI, it is now more important than ever to educate about HPV, the cervical cancer connection, and the vaccine. Even further, an investigation into the gaps in knowledge, receptivity, and intention to vaccinate are also important to understand the potential challenges associated with vaccine introduction and delivery to combat challenges that may impede success of the program.

Purpose

It is important to assess the receptivity and acceptability to the HPV vaccine in order to discuss what challenges may lie ahead. It is particularly pertinent to understand the opinions of a wide variety of stakeholders. Research to date has focused on the acceptability and knowledge of HPV vaccine and cervical cancer in several key stakeholders such as parents (DiAngi, Panozzo, Ramogola-Masire, Steenhoff, & Brewer, 2011; Wamai et al., 2012), adolescents (Binagwaho et al., 2012), health care workers (McCarey et al., 2011; Morhason-Bello et al., 2009), and teachers (Remes et al., 2012). Very limited published research is available regarding HPV, the HPV vaccine and cervical cancer knowledge and acceptability in West Africa, specifically (Perlman et al., 2014). The research resulting from this study will contribute to the literature on HPV and the vaccine in West Africa, with a specific focus on Senegal and Ghana. As the *Human Papillomavirus* is also and STI, understanding the context of sexual and reproductive health (SRH) access, knowledge, and services in sub-Saharan Africa is also important in efforts to promote the HPV vaccine.

This study is comprised of two components both of which will function together to meet the overall goal of this study which is *understanding and assessing factors influencing vaccine receptivity for adolescents and young adults in sub-Saharan Africa.*

Aims

- Investigate factors influencing the receptivity of adolescents and young adults in Senegal
- Investigate the SRH knowledge and family planning influencers, perceptions, and preferences among women, men, and key stakeholders in Ghana

This study is also comprised of two additional standalone deliverables. The first, is a publishable manuscript on HPV vaccine receptivity among adolescents and young adults in Senegal. The second deliverable utilizes the data analysis of Senegal and Ghana to inform a data brief for the Kintampo Health Research Center in Brong Ahafo, Ghana to inform future HPV awareness and receptivity challenges (see **Appendix A**).

Guiding Theory

The research proposed for this study, in keeping with the current literature on HPV vaccine acceptability (Ayissi et al., 2012; Coleman, Levison, & Sangi-Haghpeykar, 2011; DiAngi et al., 2011; Poole et al., 2013) is based on the principles of the Health Belief Model (HBM; Rosenstock, 1974). The HBM posits that decisions to undertake desired health behaviors, here receiving the HPV vaccine, are a combination of an individual's belief that they are at risk of illness (*perceived susceptibility*) and how serious they believe that health threat to be (*perceived severity*). Both *perceived susceptibility* and *perceived severity* are influenced by individual and environmental modifying factors that further influence an individual's perception of these two constructs (Earp & Ennett, 1991). An individual's *perceived severity* can also be influenced by *cues to action* that are meant to encourage or serve as reminders to participate in the desired health behavior (Glanz, Rimer, & Viswanath, 2008). The HBM also states that decisions to engage in the health behavior are also shaped by weighing the potential benefits (*perceived benefits*) against the costs engaging in the desired health behavior (*perceived barriers*). The construct of *self-efficacy* was added to the original HBM in order to account for a person's belief in their abilities to be able to complete the desired action (Glanz, Rimer, & Viswanath, 2008; "The Health Belief Model," n.d.).

Figure 1 (pg. 6), is a conceptual model depicting the constructs of the HBM specific to vaccine acceptance in sub-Saharan Africa. The conceptual model is read from left to right. The arrows indicate which concepts influence each other and can be either uni- or bi-directional. The Health Belief Model will guide the analysis of the Senegal component of this study.

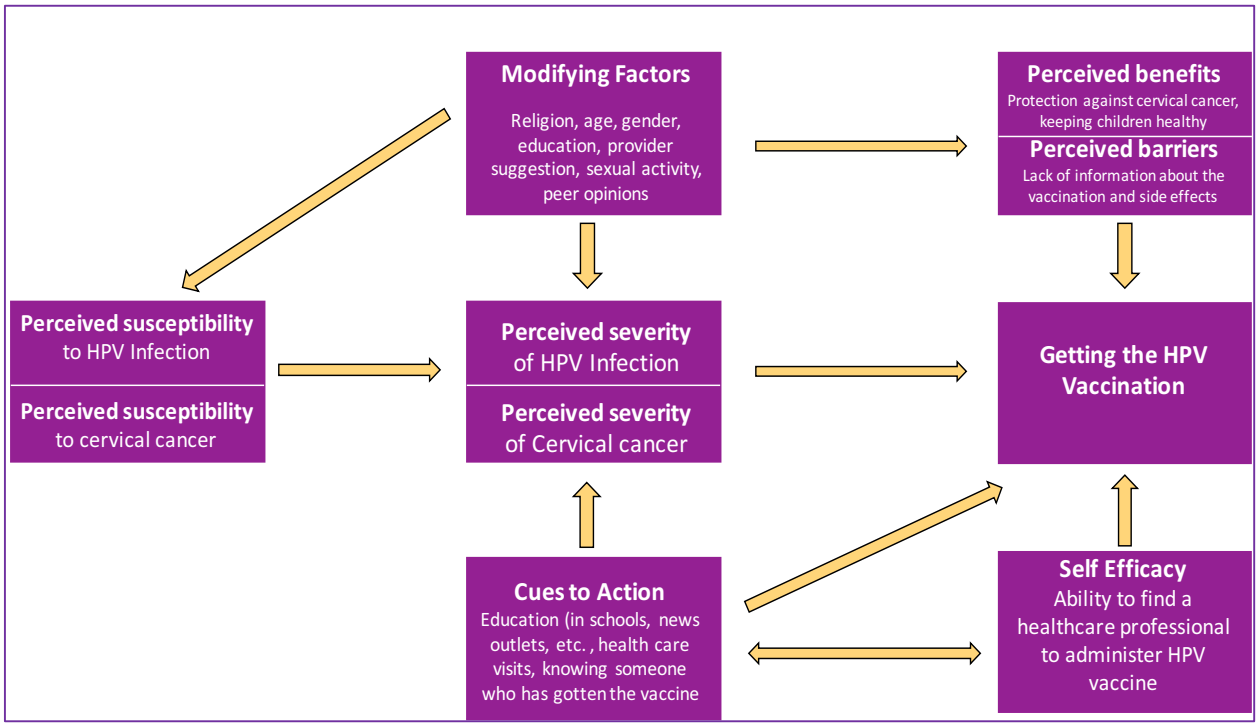
Senegal

Methods

The Senegal portion of this study drew from secondary data collected by the UCLA Fielding School of Public Health, Réseau Africain pour l'Education à la Santé, and Centre Régional de formation et de Recherche en Santé de la Reproduction in Senegal, West Africa. 2,286 adolescents and young adults ages 14-22 were surveyed using a quantitative survey instrument in French about their general health; health information seeking avenues; and their

HPV and HPV vaccine knowledge and awareness. Surveys were administered at thirteen schools in five cities and towns in Senegal: Thiés, Fatick, Dakar, Mbour, and Ziguinchor.

Figure 1: Conceptual Model of HPV Vaccine Acceptance in West Africa based on the Health Belief Model



Outcome Variables

There were four main outcomes of interest in this study. HPV awareness was assessed in the study population by asking 1) *Have you ever heard of HPV*? Among the HPV aware subsample, students were asked 2) *Do you think that HPV can be contracted through sexual contact?* This outcome was used as a measure of the respondent's *perceived susceptibility* to possible infection with HPV. Additionally, respondents were asked about the *perceived severity* associated with HPV infection, 3) *Do you think that HPV can cause cervical cancer?* Finally, students were asked to indicate their willingness to vaccinate, the main behavioral outcome of the study: 4) *A vaccine that protects against HPV, a virus that can cause cervical cancer, was recently recommended for boys and girls. Would you get the vaccine?* For each of the outcomes in this study, students could indicate, *Yes, No, or I don't know.* All four outcomes were analyzed using multinomial logistic regression and then were dichotomized for a multivariable logistic regression. The multivariable logistic regression collapsed *No* and *I don't know* into one uncertainty variable, *No or I don't know*. Multinomial and multivariable logistic regressions both produced similar results and therefore, further analysis proceeded with multivariable logistic regression. This study hypothesized that respondents who were aware the HPV was an STI and also that it could lead to cervical cancer would be more willing to receive the HPV vaccination than those who were not aware of the associations of HPV infection.

Predictor Variables

The sample were assessed for demographic characteristics including: age, area in which respondents spent the majority of their lives (suburban, urban, and rural), gender, religion, father's education, socioeconomic status (SES), self-rated health, number of doctor's visits within the last twelve months, whether or not a health professional spoke to the student regarding the HPV vaccine, and for the HPV aware sub-sample, the source of their HPV knowledge. Students were also asked to report their sources of SRH information and their barriers to accessing SRH. Three of the outcome variables, knowledge that HPV is sexually transmitted, knowledge that it causes cervical cancer, and willingness to receive the HPV vaccine also served as predictors in the three models which investigated the HPV aware subsample when they were not the outcome of interest.

Students selected from a list of sources and indicated either *Yes* or *No* as to whether these were sources of information or barriers to access. The top five most frequently cited responses were utilized for further analysis. Barriers to SRH access were examined as possible barriers to HPV awareness and vaccine willingness. Respondents were also asked to indicate on a Likert scale question their level of agreement to statements regarding their personal responsibility to meet with a physician even if they were not ill. This variable, studied as a measurement of self-efficacy.

Some of the predictor variables were modified and arranged for statistical analysis. For the religion variable, students could indicate *Muslim, Christian, Animist, Without Religion,* or *Other*. A small proportion of the sample reported religions other than Muslim and Christian; religion was subsequently dichotomized into *Muslim* and *Not Muslim* as Muslims comprised the largest proportion of the sample's religious affiliation (80%). SES was assessed in this study using questions adapted from the Senegal Demographic and Health Survey (Measure DHS, 2012) regarding in home access to items such as electricity, television, radio, computer, etc. Responses to these questions were summed and divided into quintiles. Forty-three students declined to answer questions related to self-rated health and number of doctor's visits in the past 12 months. These missing respondents were analyzed for differences in all predictor variables and the four main outcome variables. There were no differences between the missing forty-three respondents and the remaining respondents therefore they were excluded from the sample.

Statistical Analysis

All predictor variables were analyzed for frequency data and were each examined utilizing Contingency table Chi-Squares for each outcome to determine if there were statistically significant associations between the predictors and outcome variables. Outcomes and predictors were further analyzed using multivariable logistic regression. All statistical analysis was completed with STATA v. 14 (STATA, 2015) and significance was established at the $\alpha = 0.05$ convention.

Results

Table 1 describes the descriptive statistics of the overall sample and the bivariate results of ever having heard of HPV. Overall, HPV awareness in the sample was low (26%; see Table 1). Students of the lowest SES group reported greater awareness of HPV (32%) than students of higher SES groups ($p < 0.01$). Students whose teachers were their source of SRH information had lower levels of HPV awareness than those whose did not receive SRH information from their teachers ($p < 0.05$).

After controlling for all other variables in the multivariable logistic regression model, students who reported growing up in rural areas showed a 63% increase in the odds of knowing about HPV when compared to students who grew up in urban areas (95% CI: 1.23, 2.12). Students whose fathers completed higher education had a 41% increase in the odds of ever hearing about HPV. As SES quintile increased, HPV awareness decreased. SES group one showed a 25% (95% CI: 0.56, 0.99) decrease in the odds of awareness as compared to SES group 0. SES groups 2 and 3 also showed a statistically significant decrease 32% (95% CI: 0.50, 0.93) and 43% (95% CI: 0.40, 0.81) in the odds of HPV awareness as compared to SES Group 0. Higher self-rated health and increased doctor's visits were positively associated with HPV awareness; OR = 1.19 (95% CI: 1.09, 1.30) and OR = 1.07 (95% CI: 1.02, 1.12) respectively.

Table 1: Bivariate and Multivariable Logistic Regression Analysis of "Have you heard of HPV?"

Variable	I don't know or has not heard of HPV n (%)	Yes, has heard of HPV n (%)	Ever heard of HPV OR (95% CI) Reference: No
Ever Heard of HPV **(n = 2,243)**	1,658 (73.92)	585 (26.08)	
Area			
Rural	268 (69.07)	120 (30.93)	1.625 (1.24, 2.12)***
Father Education*			1.41 (1.04, 1.92)*
Did Not Attend	330 (78.38)	91 (21.62)	
Primary	228 (74.03)	80 (25.97)	
Secondary	311 (74.22)	108 (25.78)	
Higher Education	468 (70.16)	199 (29.84)	
Don't know	321 (75.00)	107 (25.00)	
SES Group*			
Group 0	333 (68.10)	156 (31.90)	
Group 1	357 (74.53)	122 (25.47)	0.745 (0.559, 0.993)*
Group 2	319 (73.33)	116 (26.67)	0.803 (0.596, 1.0809)
Group 3	348 (76.48)	107 (23.52)	0.681 (0.499, 0.929)*
Group 4	301 (78.18)	84 (21.82)	0.570 (0.403, 0.807)**
Self-Rated Health**			1.193 (1.0945, 1.299)***
Poor	42 (82.35)	9 (17.65)	
Fair	334 (73.89)	118 (26.11)	
Good	440 (78.71)	119 (21.29)	
Very Good	395 (74.67)	134 (25.33)	
Excellent	447 (68.56)	205 (31.44)	
Doctor's Visits in the last 12 months			1.0683 (1.0183, 1.121)**
None	398 (75.81)	127 (24.19)	
1 Time	381 (72.71)	143 (27.29)	
2 Times	306 (78.87)	82 (21.13)	
3 Times	202 (74.54)	69 (25.46)	
4 Times	150 (70.75)	62 (29.25)	
5-9 Times	74 (70.48)	31 (29.52)	
10 Times	72 (69.90)	31 (30.10)	
I Don't Know	75 (65.22)	40 (34.78)	

Controlling for age, gender, religion, sources of SRH information, and barriers to accessing SRH care

Table 2 details the results of the second outcome of this study, knowledge that HPV is an STI (*perceived susceptibility*). In the HPV aware sub-sample, 34% of respondents knew that HPV was an STI. The highest proportion of students who knew that HPV was an STI were those whose fathers had no education (42%; $p < 0.05$). Students who had previously spoken to a healthcare provider about the HPV vaccine were more aware that HPV is an STI than students who have not spoken to a provider about the vaccine (62%; $p < 0.001$). Students who knew that HPV is an STI showed greater willingness (57%) to receive the HPV vaccine than those students

who do not know HPV's transmission pathway. The differences in perceived susceptibility and willingness to vaccinate were statistically significant ($p < 0.001$).

After controlling for all other variables, respondents who had spoken to a healthcare provider about the HPV vaccine showed over a threefold increase in the odds of knowing that HPV is and STI as compared to those students who have never spoken to a provider about the vaccine (95% CI: 1.89, 5.36). Knowledge of HPV's link to cervical cancer (OR = 5.32; 95% CI: 3.29, 8.60) and willingness to receive the HPV vaccine (OR = 2.28; 95% CI: 1.41, 3.69) were also highly positively associated with knowledge of HPV being an STI.

Table 2: Bivariate and Multivariable Logistic Regression Analysis of "Do you think that HPV can be contracted sexually?"

Variable	No or doesn't know, that HPV is an STI, n (%)	Yes, knows that HPV is an STI, n (%)	Knows HPV is an STI OR (95% CI) Reference: No
Knowledge HPV is an STI (n = 585)	387 (66.2)	198 (33.9)	
Father Education*			n/a
Did Not Attend	53 (58.2)	38 (41.8)	
Primary	53 (66.3)	27 (33.8)	
Secondary	64 (59.3)	44 (40.7)	
Higher Education	133 (66.8)	66 (33.2)	
Don't know	84 (78.5)	23 (21.5)	
Source of HPV Knowledge* **			
Internet	21 (77.8)	6 (22.2)	0.25 (0.08, 0.79)*
Don't Remember	136 (95.1)	7 (4.9)	0.12 (0.05, 0.29)***
Spoken with health care professional about HPV vaccine* **			
No	342 (73.2)	125 (26.8)	3.10 (1.89, 5.36) ***
Yes	45 (38.1)	73 (61.9)	
Knowledge HPV causes cervical cancer* **			
No	328 (80.0)	82 (41.4)	5.32 (3.29, 8.60) ***
Yes	59 (15.3)	116 (58.6)	
Would you get the HPV vaccine?* **			
No or I don't know	314 (75.5)	102 (24.5)	2.28 (1.41, 3.69) ***
Yes	73 (43.2)	96 (56.8)	

Controlling for age, area in which respondents grew up, gender, religion, sources of SRH information, self-rated health, doctor's visits in the last 12 months, and barriers to accessing SRH care

Less than a third (30%) of respondents were aware of the severity of HPV infection and how it may lead to cervical cancer (see Table 3). There were statistically significant differences in awareness of *perceived severity* of HPV infection and father's education. While there was no clear trend, students whose father's had not attended school showed the greatest proportion (42%) of knowledge about HPV leading to cervical cancer ($p = 0.01$). Increased doctor's visits were significantly associated with increased knowledge of HPV causing cervical cancer. The highest percentage of students who knew of the connection (52%) were those who had visited a doctor more than 10 times in the past twelve months ($p < 0.01$). Students who were willing to receive the HPV vaccination were more aware (54%) of the HPV and cervical cancer than those who were not willing or did not know whether or not they wanted to be vaccinated (20%). The same trend was present for knowledge that HPV was an STI. Respondents who knew that HPV was an STI were more aware of the relationship between HPV and Cervical Cancer than those who did not know HPV was an STI ($p < 0.001$).

Table 3: Bivariate and Multivariable Logistic Regression Analysis of "Do you think that HPV can cause cervical cancer?"

Variable	No or doesn't know, that HPV causes cervical cancer	Yes, knows that HPV causes cervical cancer	Knows HPV causes Cervical Cancer? OR (95% CI) Reference: No
Knowledge HPV causes Cervical Cancer (n = 585)	410 (70.09)	175 (29.91)	
Religion			0.52 (0.27, 0.98)***
Not Muslim	88 (71.54)	35 (28.46)	
Muslim	322 (69.70)	140 (30.30	
Father Education*			n/a
Did Not Attend	53 (58.24)	38 (41.76)	
Primary	59 (73.75)	21 (26.25)	
Secondary	74 (68.52)	34 (31.48)	
Higher Education	137 (68.84)	62 (31.16)	
Don't know	87 (81.31)	20 (18.69)	
SES Group*			n/a
Group 0	102 (65.38)	54 (34.62)	
Group 1	86 (70.49)	36 (29.51)	
Group 2	74 (63.79)	42 (36.21)	
Group 3	80 (74.77)	27 (25.23)	
Group 4	68 (80.95)	16 (19.05)	
Sources of SRH information			
*TV**			n/a
No	178 (75.11)	59 (24.89)	
Yes	232 (66.67)	116 (33.33)	
Self-Rated Health			1.30 (1.06, 1.60)*
Poor	6 (66.67)	3 (33.33)	
Fair	88 (74.58)	30 (25.42)	
Good	85 (71.43)	34 (28.57)	
Very Good	101 (75.37)	33 (24.63)	
Excellent	130 (63.41)	75 (36.59)	
Doctor's Visits in the last 12 months*			1.15 (1.02, 1.29)*
None	90 (70.87)	37 (29.13)	
1 Time	102 (71.33)	41 (28.67)	
2 Times	66 (80.49)	16 (19.51)	
3 Times	50 (72.46)	19 (27.54)	
4 Times	34 (54.84)	28 (45.16)	
5-9 Times	22 (70.97)	9 (29.03)	
10 Times	15 (48.39)	16 (51.61)	
I Don't Know	31 (77.50)	9 (22.50)	
Source of HPV Knowledge***			
Doctor or HCP	111 (58.12)	80 (41.88)	
Family or friend	35 (62.50)	21 (37.50)	
Journal/Magazine	25 (55.56)	20 (44.44)	
TV Ad	41 (78.85)	11 (21.15)	
TV News	29 (63.04)	17 (36.96)	
Internet	17 (62.96)	10 (37.04)	
Radio	15 (60.00)	10 (40.00)	
Don't Remember	137 (95.80)	6 (4.20)	0.14 (0.06, 0.38)***
Spoken with health care professional about HPV vaccine***			n/a
No	347 (74.30)	120 (25.70)	
Yes	63 (53.39)	55 (46.61)	
Knowledge that HPV is an STI***			5.20 (3.21, 8.43)***
No or I don't know	328 (84.75)	59 (15.25)	
Yes	82 (41.41)	116 (58.59)	
Would you get the HPV vaccine?***			2.62 (1.60, 4.27)***
No or I don't know	331 (79.57)	85 (20.43)	

Yes	79 (46.75)	90 (53.25)	
Barriers to accessing SRH care			n/a
*Cost of care**			
No	239 (73.54)	86 (26.46)	
Yes	171 (65.77)	89 (34.23)	

Controlling for age, area in which respondents grew up, gender, and self-rated health

Higher self-rated health and increased doctor's visits were again positively associated with knowledge of HPV causing cervical cancer; OR = 1.30 (95% CI: 1.06, 1.60) and OR = 1.15 (95% CI: 1.02, 1.29). Respondents who knew that HPV was an STI showed a 5-fold increase in the odds of knowing that it also caused cervical cancer as compared to those respondents with no knowledge that HPV is an STI (OR = 5.20; 95% 3.21, 8.43). Willingness to vaccinate was also positively associated with knowledge of HPV causing cervical cancer; students who were willing to vaccinate showed greater than doubled the odds off knowing that HPV is linked to cervical cancer (OR = 2.62; 95% CI: 1.60, 4.23).

Table 4 describes respondents' willingness to receive the HPV vaccine. Statistically significant differences existed between father's education and willingness to vaccinate ($p < 0.001$). Willingness to vaccinate was highest in respondents whose fathers had no education (48%). Students who received SRH information from their teachers were more willing to vaccinate (33%) than those who did not (24%; $p < 0.05$). Willingness to vaccinate was highest in respondents who had spoken to a healthcare provider about the HPV vaccine ($p < 0.01$). Willingness to vaccinate was highest among students who knew that HPV causes cervical cancer (51%; $p < 0.001$) and among those who knew that HPV is an STI ($p < 0.001$).

Table 4: Bivariate and Multivariable Logistic Regression Analysis of willingness to receive the HPV Vaccine

Variable	No or doesn't know, that HPV causes cervical cancer, n (%)	Yes, knows that HPV causes cervical cancer, n (%)	Willingness to receive HPV vaccine OR (95%), Ref: No
Willingness to vaccinate	416 (71.11)	169 (28.89)	
Father Education* **			
Did Not Attend	47 (51.65)	44 (48.35)	
Primary	61 (76.25)	19 (23.75)	0.336 (0.155, 0.727)**
Secondary	76 (70.37)	32 (29.63)	0.403 (0.201, 0.806)*
Higher Education	141 (70.85)	58 (29.15)	0.414 (0.217, 0.793)**
Don't know	91 (85.05)	16 (14.95)	0.214 (0.0958, 0.477)***
Sources of SRH information			
*Teachers**			n/a
No	192 (75.89	61 (24.11)	
Yes	224 (67.47)	108 (32.53)	
Parents			0.56 (0.36, 0.88)*
No	162 (67.50)	78 (32.50)	
Yes	254 (73.62)	91 (26.38)	
Self-Rated Health*			n/a
Poor	9 (100.00)	0 (0.00)	
Fair	81 (68.64)	37 (31.36)	
Good	88 (73.95)	31 (26.05)	
Very Good	104 (77.61)	30 (22.39)	
Excellent	134 (65.37)	71 (34.63)	

Table 4: Bivariate and Multivariable Logistic Regression Analysis of willingness to receive the HPV Vaccine (cont.)

Variable	No or doesn't know, that HPV causes cervical cancer, n (%)	Yes, knows that HPV causes cervical cancer, n (%)	P-value
Source of HPV Information ***			n/a
Doctor or HCP	124 (64.92)	67 (35.08)	
Family or friend	36 (64.29)	20 (35.71)	
Journal/Magazine	29 (64.44)	16 (35.56)	
TV Ad	35 (67.31)	17 (32.69(	
TV News	27 (58.70)	19 (41.30)	
Internet	18 (66.67)	9 (33.33)	
Radio	16 (64.00)	9 (36.00)	
Don't Remember	131 (91.61)	12 (8.39)	
Spoken with health care professional about HPV vaccine**			n/a
No	346 (74.09)	121 (25.91)	
Yes	70 (59.32)	48 (40.68)	
Barriers to accessing SRH care			n/a
*Don't want parents to know**			
No	210 (75.27)	69 (24.73)	
Yes	206 (67.32)	100 (32.68)	
*Difficulty asking SRH questions***			
No	222 (77.62)	64 (22.38)	
Yes	194 (64.88)	105 (35.12)	
*Fear of being judged***			
No	224 (75.93)	71 (24.07)	
Yes	192 (66.21)	98 (33.79)	
*Don't know where to go**			
No	257 (74.49)	88 (25.51)	
Yes	159 (66.25)	81 (33.75)	
Knowledge that HPV is an STI***			2.260 (1.406, 3.632)**
No	314 (81.14)	73 (18.86)	
Yes	102 (51.52)	96 (48.48)	
Knowledge that HPV causes cancer***			2.773 (1.713, 4.487)***
No	331 (80.73)	79 (19.27)	
Yes	85 (48.57)	90 (51.43)	

Controlling for age, gender, religion, SES, and doctor's visits in the last 12 months

Table 4 also contains the multivariable logistic regression of respondents' willingness to receive the HPV vaccine. After controlling for all other variables, every level of father's education showed a negative association with willingness to vaccinate as compared to the respondents whose father's had received no education (see table 5). Respondents who receive SRH information from their parents showed a 43% decrease in the odds of willingness to vaccinate (95% CI: 0.36, 0.88). Knowledge that HPV is an STI (*perceived susceptibility*) and that HPV infection can lead to cervical cancer (*perceived severity*) were positively associated with an increase of the odds of willingness to vaccinate. Knowledge of HPV being and STI more than doubled (OR = 2.26) the odds of willingness to receive the vaccine (95% CI: 1.41, 3.63). Similarly, knowledge that HPV was an STI was associated with more than a 2.5-fold increase (OR = 2.78) in the odds of being willing to vaccinate (95% CI: 1.71, 4.49).

Discussion

The results of this study reveal an overall need to raise awareness about HPV, the transmission pathway, cervical cancer, and the HPV vaccine. Healthcare providers in this study were an important source of HPV and SRH health information. Respondents who had had more

opportunities throughout the year to interact with physicians were more aware of HPV and also showed an increase in the odds of knowing that HPV causes cervical cancer. Visits with physicians and other health care professionals provide an important opportunity to raise awareness among adolescents and young adults in Senegal. It is important to continue to use healthcare providers and visits as an opportunity to education and raise awareness among adolescents and young adults, but the results of this study reveal that information regarding HPV, cervical cancer, the vaccine are often segmented. Adolescents and young adults who had spoken to a provider about the HPV vaccine showed a statistically significant increase in the odds of knowing that HPV was an STI as compared to those who had not. However, the same was not true of knowledge of HPV leading to cervical cancer. Statistically significant increases in the odds of knowing HPV leads to cervical cancer were only seen in respondents with increased doctor's visits. It is important for healthcare providers to educate adolescents and young adults about both aspects of HPV infection and cervical cancer at all points. Knowledge about the transmission and results of persistent infection were highly important for the end behavior of increasing willingness to vaccinate.

Perceived susceptibility to infection and perceived severity of the infection leading to cervical cancer mattered tremendously in this study. These two factors more than doubled the odds of being willing to vaccinate. These results underscore the importance of continuing to provide full and complete information and raising awareness of why the HPV vaccine is necessary. Simply by increasing awareness of these two predictors, this study showed that youth and adolescents could be more receptive to vaccination when they believe vaccination to be beneficial in protecting them from future infection and illness. Awareness and education campaigns should focus attention on increasing not only awareness about the availability of the HPV vaccine but also on ensuing that students understand the transmission of HPV and the benefit of avoiding cervical cancer. However, adolescents and young adults are not the only stakeholders in need of more information, but parents should be provided with greater access to information as well.

Parents as stakeholders to their children's health need to be provided with more information to help them remain informed decision makers for their children health. Although students with highly educated fathers in this study were more aware of HPV, these same students, when compared to students whose father's had no education, showed a reduction in the odds of being willing to vaccinate. Previous studies have revealed several parental concerns and hesitations regarding HPV vaccination namely that it may lead to future infertility, concerns over the side effects of the vaccine, and parents not seeing the need to vaccinate sexually inactive girls (Perlman, et al., 2014). Some parents also express a general a desire to simply have more information regarding the vaccine, HPV, and cervical cancer (A. Sidibe, personal communication, February 4, 2016). Education and awareness programs need to address these concerns upfront. Effective strategies have emphasized the safety and efficaciousness of the vaccine, leveraged the recommendation of the WHO, and have focused an emphasis on the benefit of the vaccine to prevent cervical cancer (PATH & LSHTM, 2015). Providing parents with accurate information will help them filter rumors and misinformation regarding the HPV vaccine that can also hamper vaccine receptivity (A. Sidibe, personal communication, February 4, 2016; PATH & LSHTM, 2015).

Limitations

There are some limitations to the outlined study. The overall sample size for this study was small and decreased further for multivariable logistic regressions of the HPV aware sub-sample. The smaller sample size may limit the overall generalizability of the results. Additionally, may of the predictor variables had multiple categories for respondents to choose (i.e. – barriers to accessing SRH care). This resulted in a model with several predictors and low r^2 values for each of the models.

Conclusion

Sub-Saharan African countries continuously face the dual challenge of battling emerging and infectious diseases. Today they also face the additional challenge of attending to these illnesses and chronic diseases as well. Cervical cancer is a growing problem in sub-Saharan Africa. Increased access to primary preventative services for women and girls to prevent the onset of HPV infection is a significant tool to promote women's health, prolong life, and to decrease the global disparity in cervical cancer mortality.

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Appendix A –HPV Vaccine Receptivity: Challenges and Best Practiced for the Kintampo Health Research Center

Ghana

Methods

The Ghana component of this study similarly examined secondary data on sexual and reproductive health practices and preferences of Ghanaian men and women collected in a cross-sectional study by the Kintampo Health Research Center as a part of the Kintampo Health and Demographic Surveillance System (KHDSS; Abubakari et al., 2015; Enuameh et al., 2015). Details of the data collection are described elsewhere (Enuameh et al., 2015). In total, 8,364 respondents were surveyed under the KHDSS in the North and Southern regions of Brong Ahafo (Enuameh et al., 2015). Analysis of the sexual and reproductive health seeking behavior of men and women in Ghana was utilized to shed any light on knowledge, access, influencers, perceptions, and preferences among women, men, and key stakeholders.

Predictor Variables

Data from the female sample were examined for demographics including age, area in which respondents were surveyed, educational attainment, religion, and SES. Further, frequencies for daughters in the sample were also analyzed, sourced of family planning information, and preferred contraceptive methods. Respondents were also asked questions about current contraceptive use, which types of contraceptive methods they have heard of or had ever used, and reasons for not currently using contraceptives.

Awareness of contraceptive methods were recorded as either a spontaneous or prompted *Yes* or *No.* For analysis, spontaneous or prompted *Yeses* were collapsed into one affirmative *Yes* variable. Respondents could indicate *Catholic, Protestant, Pentecostal/Charismatic, Muslim, Traditional/Spiritualist, No Religion, Other Christian, and Other Religions* for their religious affiliation. Due to the low proportion of respondents reporting *Protestant* respondents, this selection was condensed into *Other Christian* and *Traditional/Spiritualist* was for similar reasons condensed into *Other Religions.* Respondent to this survey also indicated their source of contraceptive methods and contraceptive knowledge. There were numerous options for respondents to choose from each under the heading of *Public Medical Sector, Private Medical Sector, or Other Source.* These options were subsequently condensed into their respective headings for further analysis.

Statistical Analysis

All predictor variables were analyzed for frequency data. Similar survey questions for males and females were examined bivariate to assess practices and preferences by gender. All statistical analysis was completed with STATA v. 14 (STATA, 2015).

Results and Discussion - Ghana

The results and discussion of the secondary data analysis of the Kintampo Health Research Center Data are outlined in a Data Brief for KHRC below.

Limitations

This study and the prepared data brief are not without limitations. Primarily, the data for this portion of the study centers surrounding sexual and reproductive health and family planning and not on HPV, specifically. Therefore, inferences from this study are based on overarching sexual health with a focus on contraception rather than HPV or the HPV vaccine. However, this is a complementary study and given the nature of HPV infection (a sexually transmitted disease), it is plausible that SRH and FP information can be used to inform HPV, cervical cancer, and HPV vaccine related activities.

The data for this study were generated by two separate surveys, one for men and the other for women. Due to differences in sample size and questions asked in the study, cross gender comparisons were limited. This study instead focuses on general comparisons among women and among men and focuses on frequencies. Future studies should explore the statistical differences in responses for men and women.

Lessons learned from family planning programs to inform future HPV Vaccine education strategies

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Key Findings

- Preventative programs such as family planning (FP) were generally seen in a positive light, making HPV prevention plausible in this population
- Men and women generally have high knowledge of contraceptive methods and make the decision to utilize contraceptives jointly
- The radio, television, and social settings can be used to communicate about HPV, cervical cancer, and the HPV vaccine
- Communicating the need to vaccinate may face challenges relating to fears of sexual promiscuity, fear of side effects, and rumors or misinformation regarding the vaccine

Introduction

Cervical cancer is the most common cancer affecting women in sub-Saharan Africa[1] where 85% of cervical cancer mortality lies[2]. Ghana has the 4th highest age-standardized incidence of cervical cancer mortality in West Africa[3]. Limited screening and treatment facilities to detect for abnormal cervical cells and treat cervical cancer[4] make primary prevention efforts, preventing cervical cancer before it begins, more pressing. The HPV vaccine presents an opportunity to protect women and girls from future HPV infection and cervical cancer. As the vaccine becomes more widely available in sub-Saharan Africa[5], and Ghana in particular, it is necessary to understand any barriers and facilitators to HPV awareness and vaccine receptivity.

This data brief draws on sexual and reproductive health (SRH) and family planning (FP) data collected from the population covered by the Kintampo Health and Demographic Surveillance System of the Kintampo Health Research Center in the Brong Ahafo Region, Ghana in 2011. This brief examines knowledge/access to SRH and FP services as well as influencers/perceptions to and regarding the use of these services to inform any possible challenges or directions for future HPV awareness campaigns for the Brong Ahafo region.

Demographics

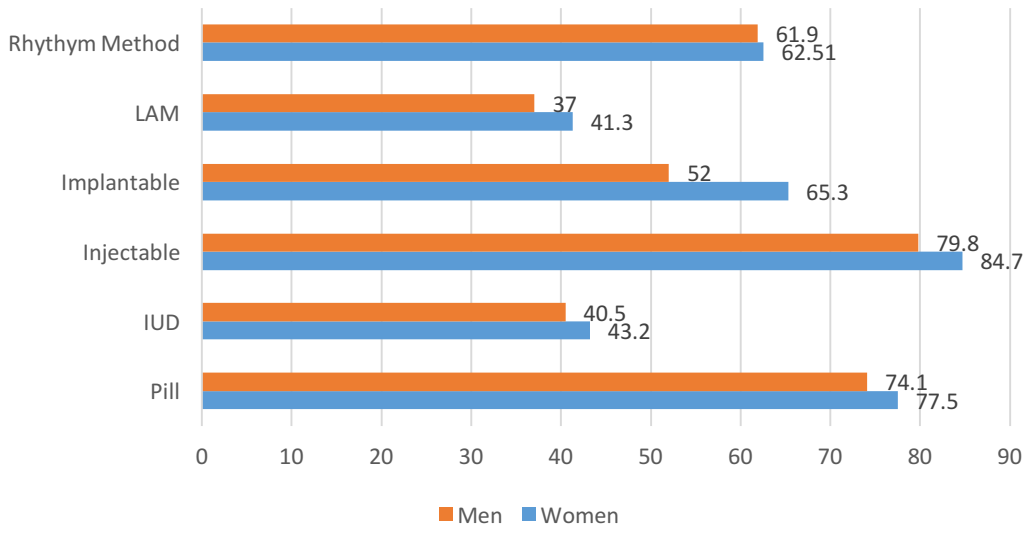
Demographic data were collected for the women surveyed:

- Women ranged in age from 10-49, highest proportion of respondents were age group 15-19 (18.8%)
- 62% of the respondents live in rural areas
- 60% were Christian, 29% were Muslim, 11% were other or no religion
- The majority of female respondents (39%) have never attended school
- Socioeconomic status was varied with highest proportions (23%) in Less Poor or Least Poor category

Knowledge and Access to Family Planning and Sexual and Reproductive Health Methods and Services

- Men and women are highly aware of modern and traditional forms of contraception[1]. Overall, there are high levels of awareness of the various preventative strategies available to them for FP.

Figure 1: Percentages of respondents who have heard of selected contraceptive methods by female and male

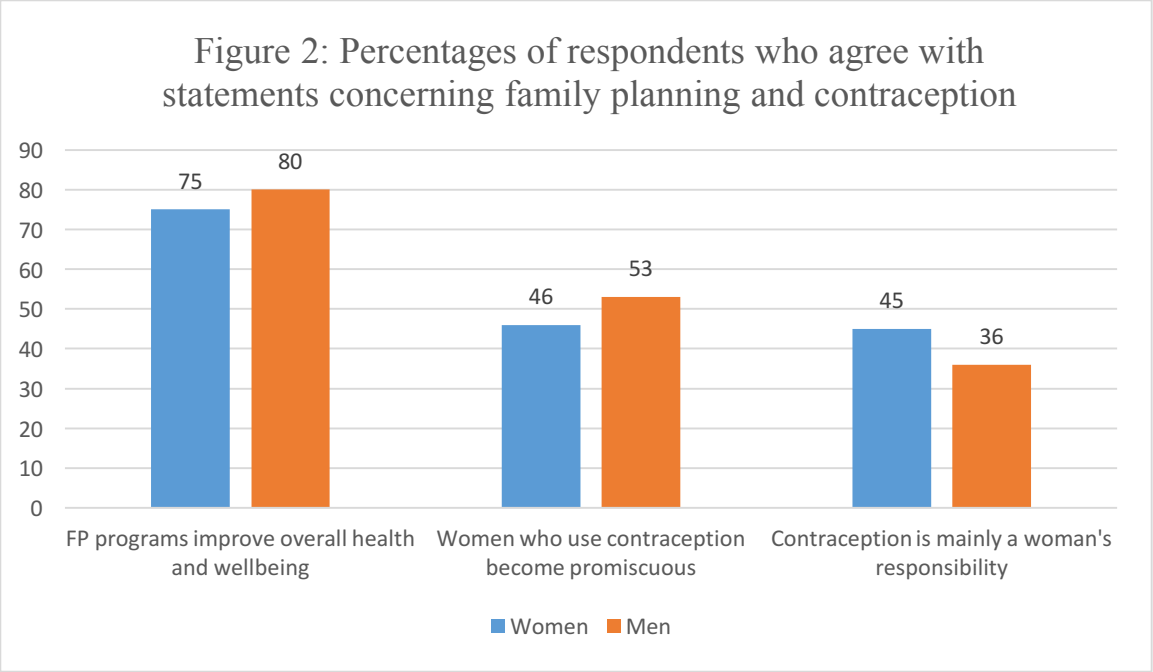


- Popular information channels for both men and women to access FP information were the radio (57% of men, 47% of women), television (27% of men, 26% of women), and social settings (23% of men, 29% of women). These channels represent avenues to increase the reach for HPV/HPV vaccine awareness campaigns.

Influencers and Perceptions to use of Family Planning and Sexual and Reproductive Health Methods and Services

- Attitudes and perceptions regarding family planning programs provide an opportunity to pre-identify possible challenges to an HPV education program
- Overall, men and women have positive perceptions of FP programs. 75% of women and 80% of men agreed that FP programs improved overall health and well-being.
- Although men and women have positive views on FP programs for overall health, 46% of women and 53% of men hold the belief that use of contraceptives may make a woman promiscuous which may challenge overall utilization of FP services.
- Less than half of women (45%) and men (36%) who were using contraceptives believe contraceptives to be primarily a woman's responsibility
- Women most commonly reported (73%) making decision to use contraceptives jointly with their partners.

[1] Cross sex comparisons cannot be made due to the difference in sample size for men and women in this study



- Only 18.3% of women using a current contraceptive method were informed by their healthcare provider about possible side effects of their contraceptive method. Contraceptive compliance has been hampered in the past with African men and women due to fear of side effects[6,7] which presents an important focus when promoting the HPV vaccine.

Recommendations

- Several studies in sub-Saharan Africa have revealed low levels of awareness of HPV, cervical cancer, and the HPV vaccine[8]. It will be important to therefore, first increase overall awareness.
- Frame messaging to focus on the benefit that the HPV vaccine provides, namely the prevention of cervical cancer.
    - As HPV is an STI, some might refuse the vaccine over concerns that vaccination will encourage early sexual debut[9]. There are also already concerns regarding promiscuity and contraceptive use, therefore HPV education messages need to be framed to emphasize the protection that the vaccine provides against cervical cancer
- Popular media channels, the radio and the television, in addition to interpersonal communication (social settings) should be utilized to increase overall awareness. Entertainment education programs have been effective in sub-Saharan Africa and have helped to modify health behaviors[10,11].
    - Given that men and women make their decision regarding contraceptive use jointly, providing entertainment education through popular channels may also contribute to continued dialogue about the HPV vaccine by parents and caregivers who are decision makers for girls eligible for vaccination
- The data suggests that while general awareness of contraceptive methods, this information falls short of informing women what effects may be associated with use. This

presents a twofold challenge for vaccine education and delivery. First, awareness campaigns need to incorporate possible side effects to vaccination, which are minimal compared to the benefits. Secondly, addressing possible side effects during awareness campaigns will help to continue to ensure that parents and adolescents are informed stakeholders in their healthcare decisions while also giving them the information necessary to counter any rumors that might lead to vaccine refusal.

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